Remarks

This Preliminary Amendment cancels without prejudice original claims 1-2 in the underlying PCT Application No. PCT/GR2003/000037 and adds new claims 3-9. The new claims conform to U.S. Patent and Trademark Office rules and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.125(b), the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. § 1.121(b)(3)(ii) and § 1.125(c), a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) are respectfully requested.

The underlying PCT Application No. PCT/GR2003/000037 includes an International Search Report, dated January 23, 2004. The Search Report includes a list of documents that were uncovered in the underlying PCT Application.

Applicant asserts that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully Submitted,

KENYON & KENYON

(R. No. 36,197)

Dated: 9/22/05

By: JONG LEE for Gerard Messina

Gerard A. Messina
(Reg. No. 35,952)
One Broadway, NY, NY 10004
(212) 425-7200
CUSTOMER NO. 26646

[13489/1]

FLOATING SOLAR CHIMNEY

Field of the Invention

The present invention ~~concerns~~relates to solar chimney that can collaborate with solar collectors and wind turbo generators and form electric power stations working by solar power.

Background Information

Such conventional electric power systems using solar energy, with the method of solar collectors and solar chimneys, are based on the principle of solar heating of air in a solar collector of a large area. The warm air ~~is up-drafting~~rises, through a collaborating solar chimney that is based on the center of the collector, to ~~superior~~upper layers of atmosphere, acquiring up-draft speed, due to the height of the solar chimneys. Part of the thermo mechanical energy of this up-drafting current of warm air, via a system of the wind turbines and generators in the base of the solar chimney, transforms into electric energy. The solar chimney in this conventional system is typically manufactured by reinforced concrete. This has the following consequences:

- High manufacturing cost; and
- Limited height of the solar chimneys due to technological restrictions from the construction materials and from exterior limitations (e.g., earthquakes ~~e.g.~~).

It is known that the output of such a power station is approximately proportional to the product of the height of solar chimney ~~to~~and the area of the collaborating solar

collector. Thus, for a given power output from such a solar power station, the height of the solar chimney determines the area of its collaborating solar collector.

Information about solar chimneys can be found in the book "THE SOLAR CHIMNEY ELECTRICITY FROM THE SUN", by JORG SCHLAICH, 1995.

Summary

The ~~proposed~~present invention ~~aims to eliminate all pre-mentioned~~eliminates the above-mentioned disadvantages by increasing, for a given power output, the height of the solar chimney, and decreasing their construction cost ~~and~~as well as the area of the solar collectors, and ~~therefore~~thereby decreasing the total cost of the ~~respective~~overall power ~~plant of~~system for generating electricity.

This ~~can be~~is achieved ~~if we construct~~by constructing the solar chimney with a double wall formed from durable elastic ~~of~~for balloons or airships, filled with gas He (or other non-flammable light gas) that makes the chimneys lighter than air. The lighter-than-air floating solar chimney can have much bigger height than the ~~corresponding~~conventional solar chimney formed from reinforced concrete, while simultaneously its costs ~~remains~~ remain considerably lower than the cost of a conventional chimney from reinforced concrete.

The construction of a floating, lighter-than-air chimney is ~~feasible~~implemented taking into consideration that the solar chimney is used exclusively for the up-drafting of warm air. Thus solar chimney stresses arise from the exterior winds and the Bernoulli pressure from the internal stream of warm air. ~~A clever~~ An advantageous, simple and inexpensive construction

can face these stresses effectively. The modern plastic and ~~composed~~composite materials that are used for airships or balloons can be used for such a construction, combining light weight and high strength in the face of extreme stresses, with ~~long~~extended life under ~~any~~extreme exterior conditions.

~~The~~Some advantages of the ~~proposed~~present invention are ~~very important and indicatively but not exclusively are~~ as follows:

- The height of the floating solar chimney can be ~~unlimitedly~~ increased up to some optimal height that ~~will be determined~~is dictated by the materials, technology and cost.

- The construction cost of the floating solar chimney ~~will be~~is considerably lower than the cost of a conventional reinforced concrete chimney.

- The cross-section of the floating solar chimney can easily be altered with the height for the optimal operation of the solar chimney.

- The area of the collaborating solar collector ~~will be~~is decreased proportionally to the increase of height for the same nominal power output of the solar power station, and ~~consecutively~~consequently the construction cost of the solar collector ~~will decrease~~is decreased proportionally.

- An optimal combination of the height of the floating solar chimney and the area of the solar collector can be chosen for the achievement of the optimal ~~techno~~technical and economical ~~result~~results.

- Seismic activity of the region does not influence the construction.

~~Hence the proposed invention could make~~In this manner, the present invention may enable the electrical power solar stations with floating solar chimneys to be economically competitive to other electrical power stations per ~~kW of power of~~ kWh of produced energy.

Brief Description of the Drawings

Figure 1a shows an example embodiment of a floating solar chimney according to the present invention, in vertical position.

Figure 1b shows the floating solar chimney in a decline position.

Figure 2 shows an example embodiment of a balloon ring D1 incorporated in the floating solar chimney according to the present invention.

Figure 3 shows an example embodiment of a supporting ring D2 incorporated in the floating solar chimney according to the present invention.

Detailed Description

The ~~proposed~~ floating solar chimney according to the present invention is based (anchored) on the seat (1.4) as shown in ~~figure~~Figure 1a:

- The Main Chimney (1.1) ~~is composed by parts. This~~ has a double wall filled with lighter-than-air inflammable gas that creates the necessary buoyancy ~~force~~. This lifting

force ~~compels~~dictates the main chimney to take, without exterior winds, a vertical position.

- The Heavy Mobile Base (1.2), also called the Heavy Base, by which the main chimney is suspended~~. The~~, has a total weight ~~of this heavy base~~that is ~~bigger~~greater than the force represented by the total buoyancy of the main chimney. This ~~has a result~~dictates, ~~without~~ in the absence of exterior winds, the heavy mobile base to sit on the seat (1.4) of the chimney.

- The folding lower part of the chimney (1.3) ~~which without exterior winds~~ is inside the upper part of the seat (1.4) in the absence of exterior winds.

If exterior winds appear, the main chimney (1.1) declines to a balance angle. The heavy base (1.2) supported in the edges of the seat (1.4)~~receives also~~ assumes a corresponding declined position, and the folding part of the chimney (1.3) that is fixed in the lower part of the ~~Heavy Base,~~heavy base is lifted off and ~~receives~~accommodates this decline, ensuring the continuity of the chimney, as it appears in ~~figure~~Figure 1b.

An ~~indicative way~~example of constructing a floating chimney is presented in the following paragraphs. ~~The proposed way of construction is indicative, because there are several ways in doing so.~~ The ~~proposed~~ example construction ~~is based on the idea of developing~~implements the main solar chimney with horizontal balloon cylindrical rings (Ring D1, ~~figure~~Figure 2) from flexible wrapping of balloons or airships (with ~~a~~an average surface density of ~~0,068~~0.068 kg/sqm). Each cylindrical balloon ring D1 is filled with gas He (that gives a lifting force under regular conditions ~~10,36~~10.36 Nt/m) or other light non-flammable gas (e.g., NH3 with lift force under

regular conditions ~~4,97~~4.97 Nt/m). The ring has an orthogonal cross-section and filling valves ~~of fulfillment~~. The dimensions of orthogonal cross-section of ring D1 depend mainly ~~from~~on the diameter of solar chimney. Each cylindrical ring will be separated from next ~~from~~by a durable~~, in horizontal stresses,~~ supporting ring D2 (~~figure~~Figure 3). Rings D2 ~~will~~may be manufactured by pipes of hard plastic or ~~composed~~composite materials or aluminum with suitable diameter and thickness. Hence the ring D2 supports balloon ring D1 from compressive forces of deformity. The total weight of ring D2 has to be smaller than the ~~remain~~ lift force of the balloon ring D1. Thus each balloon ring D1 will be able to ~~lift~~rise up to any atmospheric height as part of the floating solar chimney, lifting together at least one support ring D2. The exterior part of each ring D2 will have suitable tips for the fastening ~~of~~to other rings~~,~~ D2 ~~between them,~~ with the help of threads of high strength, in order that intermediary balloon rings to be under pressure.

The ~~proposed~~present floating solar chimney ~~is~~includes a set of independent successive parts which are each constituted by a ~~constant~~fixed number of balloon rings and supporting rings D2. Each part is a compact durable set that can float due to its buoyancy. Each part of the chimney is suspended by at least three threads of high strength by the upper part of the Heavy Mobile Base (1.2), ~~see figure~~as shown in Figure 1a.

Thus each part can ~~receive~~accommodate any declined position imposed by exterior winds without problem. The successive parts of the floating chimney are separated~~, with~~ by a separating balloon ring ~~D1, full from~~filled with air from the environment, which ~~instead of valve of fulfillment,~~separating balloon ring has a simple aperture or a special valve that allows air to enter and ~~to come out~~exit depending on the

relative movement of successive independent parts of chimney by variable exterior winds. With ~~this~~these intermediate, separating air rings, each part of the floating solar chimney becomes dynamically independent from the ~~rests~~rest. The main floating solar chimney (1.1) is ~~the sum of~~constituted by these successive and dynamically independent parts fastened independently to the Heavy Base. ~~This set~~The main floating solar chimney, and every component part of it, can ~~self~~ float and stand the forces from the Bernoulli pressures caused by the internal updraft of warm air and the exterior winds. The thickness of balloon ring D1 is sufficient for the satisfactory heat insulation of the internal warm current of air ~~that runs~~, which circulates through the solar chimney, from the exterior air that has a lower temperature.

The main floating solar chimney (1.1) ~~leads~~is coupled to ~~its~~the Heavy Mobile Base (1.2). The Heavy Mobile Base (1.2) is constituted by two rings of equal weight that are connected ~~between them~~ with exceptionally durable threads with high strength and high modulus, ~~invested~~which threads are provided with flexible durable plastic films, so that ~~it~~the Heavy Mobile Base can ~~receive~~accommodate any decline position while ~~remains~~remaining attached to the top of the seat of chimney. The total weight of the Heavy Base (1.2) exceeds the overall lift force of the main chimney, and the Heavy Base forms ~~with this~~ a single set with the main chimney. Under regular conditions the upper ring of the Heavy Base, which is manufactured with bigger diameter than the diameter of the upper part of the seat (1.4), sits on the seat of the chimney (1.4), while the lower ring, ~~that~~which has smaller diameter than the internal diameter of upper part of the seat (1.4), remains inside the seat (1.4) of chimney. ~~By~~From the lower part of the internal ring of the Heavy Base (1.2), ~~is suspended~~ the ~~final~~ folding part (1.3) of the floating solar

chimney is suspended. This folding part (1.3), which has ~~type~~ an accordion configuration, is constructed in a similar way as the main chimney, with the difference that the balloon rings that constitute ~~it, instead of valve of fulfillment~~the folding part (1.3) have a simple aperture (or a special valve) which allows the air of the environment to enter and ~~to come out of them,~~exit depending on the decline of main solar chimney. The height of the folding part (1.3) is ~~calculated~~selected so that it can receive the maximum decline of the main solar chimney.

The threads of high strength and modulus, combined with the intermediate supporting rings D2, ensure the strength of this folding part (1.3) ~~to~~ against the applied forces ~~that it accepts~~ and ~~they do not allow~~prevent the deformity of its cross-section when it is declined and unfolded. This allows the smooth operation of the floating solar chimney when exterior winds appear that compel the solar chimney to ~~receive~~assume a decline angle of balance.

If a floating solar chimney is free, i.e., without the presence of exterior winds, it will have a vertical position, ~~forced~~dictated by the net lift force of main chimney's balloon rings D1, (~~figure~~Figure 1a). The exterior winds compel the floating solar chimney to ~~receive~~assume a decline, which the heavy base ~~follows~~ and ~~finally~~ the folding part ~~receives it~~assumes, as shown in ~~figure~~Figure 1b. The angle of decline will be the one for which the normal drag force, from the vertical on the chimney component of the wind velocity, is equal to the counterbalancing component of net lift force of floating solar chimney.

In this case the dynamic field of flow of exterior winds facilitates the ~~coming out~~emission of hot air ~~at~~through the top of the solar chimney, and consequently facilitates the

updraft movement of warm air inside the main chimney.

This action ~~potentially~~ compensates for the reduction of active height of the floating solar ~~chimneys~~chimney due to the decline that ~~receives~~occurs when exterior winds appear. Thus the power output by floating solar chimney can be practically independent of exterior winds.

The appropriate place of installment of ~~this~~the solar power station should be chosen ~~in order~~such that the expected local winds do not exceed ~~some~~a threshold strength for safety reasons. The threads of high strength ~~via~~ which ~~becomes~~facilitate the fastening of the rings D2 ~~between them~~ and the final fastening to the Heavy Base (1.2) ~~can~~ ensure the safe withholding of the floating solar chimney under the most unfavorable conditions of exterior winds ~~even if these do not have practical probability to appear~~.

~~DESCRIPTION OF FIGURES~~

~~Figure 1a: Floating Solar Chimney in vertical position (without exterior winds).~~

~~1.1 Main Chimney~~

~~1.2 Heavy Mobile Base~~

~~1.3 Holding Lower Part~~

~~1.4 Chimney's Seat~~

~~1.5 (N 1) the part of the main chimney.~~

~~Figure 1b: Floating Solar Chimney in decline.~~

~~1.1 Main Chimney~~

~~1.2 Heavy Mobile Base~~

~~1~~

~~1.3 Holding Lower Part~~

~~1.4 Chimney's Seat~~

~~1.6 Vector of Direction of wind~~

~~Figure 2: Cylindrical Balloon Ring of Floating Solar Chimney (Ring Dl).~~

~~2.1 Internal Diameter of ring~~

~~2.2 Width of ring~~

~~2.3 Thickness of ring~~

~~Figure 3: Supporting Ring (ring D2).~~

~~3.1 Internal Diameter of ring D2~~

~~3.2 Width of ring D2~~

~~Note: Dimensions 2.1, 3.1 are roughly equal to the dimensions 2.2 and 3.2 respectively.~~

ABSTRACT

~~The~~ A floating solar chimney ~~is composed by~~ includes ~~three~~ several parts, ~~as appear in figure 1(a). The~~, e.g., the Main Chimney ~~(1.1). The~~, the Heavy Base ~~(1.2). The~~, and the Folding Lower Part ~~(1.3)~~. The main chimney ~~(1.1) is composed by~~ includes cylindrical balloon rings ~~D1 (fig 2)~~ full of non flammable light gas. ~~This~~ The cylindrical balloon rings ~~D1~~ are tied ~~up between them~~ with the help of supporting rings ~~D2 (fig 3)~~ so that together they form ~~a~~ one or more compact units ~~thermo insulated cylindrical~~ of the main chimney. The compact parts of the main chimney are fastened on the ~~mobile~~ heavy base. The successive compact parts are separated ~~with~~ by separating rings ~~D1 full from~~ filled with environmental air that can go in and out of the separating rings, so that the dynamic independence of the successive compact parts is ensured. The main chimney, which can float~~; self lifted and~~, is ~~fastened~~ configured to sit on ~~the~~ a chimney seat ~~(1.4) by~~, and is connected to the ~~mobile~~ heavy base ~~(1.2)~~. ~~In the~~ The lower part of ~~its~~ the heavy base is fastened to the folding lower part ~~of solar chimney (type accordion, 1.3)~~. The air can enter and come out freely from the rings of folding lower part in order ~~that~~ to enable the floating solar chimney ~~can receive~~ to achieve any suitable decline ~~in order to withstand~~ as dictated by the exterior winds ~~(fig 1b)~~.